

APPENDIX:
DETAILED DATA TABLES

Table A-1. National expenditures for the performance of R&D: 1975–96

Year	Japan				United States	
	[Millions of current yen]	[Japan deflator]	[Millions of constant yen]	[PPP conversion]	[Millions of constant 1987 dollars 1/]	
1975.....	¥2,737,000	0.71	¥3,834,828	279.60	\$18,172	\$72,237
1976.....	3,054,400	0.77	3,992,396	283.60	18,919	75,043
1977.....	3,358,920	0.81	4,124,347	282.70	19,544	76,720
1978.....	3,725,080	0.85	4,392,906	276.70	20,817	80,070
1979.....	4,217,280	0.87	4,827,237	260.90	22,875	84,061
1980.....	4,826,320	0.91	5,319,981	250.00	25,210	87,649
1981.....	5,502,795	0.92	5,997,921	242.70	28,423	91,408
1982.....	6,014,874	0.93	6,453,178	232.50	30,580	95,541
1983.....	6,621,186	0.95	7,001,630	226.80	33,179	102,285
1984.....	7,302,421	0.97	7,546,886	223.20	35,763	111,201
1985.....	8,274,717	0.98	8,424,366	219.10	39,921	120,600
1986.....	8,562,752	1.00	8,562,752	217.50	40,577	123,321
1987.....	9,162,095	1.00	9,162,095	211.00	43,417	125,376
1988.....	9,931,859	1.00	9,900,822	203.90	46,917	127,831
1989.....	11,075,422	1.02	10,837,606	199.00	51,357	129,892
1990.....	12,277,538	1.04	11,749,604	195.30	55,678	133,999
1991.....	12,923,892	1.07	12,043,004	193.70	57,069	136,300
1992.....	13,001,112	1.09	11,917,686	186.70	56,475	136,197
1993.....	12,736,831	1.10	11,597,666	184.30	54,958	133,780
1994.....	12,626,894	1.10	11,464,836	181.10	54,329	133,483
1995 (prelim.).....	NA	1.10	NA	181.30	NA	139,408
1996 (prelim.).....	NA	1.09	NA	177.00	NA	140,893

1/ Conversion of Japanese yen to U.S. dollars is calculated with purchasing power parity exchange rates from the Organisation for Economic Co-operation and Development. Numbers for constant yen and constant dollars are derived from deflator and PPP data.

KEY: NA = not available

NOTES: R&D data for Japan are based on OECD's "adjusted series" for Japan, for better international comparability. (See Methodology and Notes on Data Series.) U.S. data are preliminary for 1995 and 1996. Constant 1987 dollars for the United States are based on U.S. Department of Commerce GDP implicit price deflators.

SOURCES: For Japan, 1981–94 data: Organisation for Economic Co-operation and Development, Main Science and Technology Indicators (MSTI), Paris, OECD, December, 1996; for earlier data for Japan, 1975–80, OECD/MSTI 1990, special tabulations; for the United States, Science Resources Studies Division, National Science Foundation, *National Patterns of R&D Resources: 1996*, NSF 96-333 (Arlington, VA: NSF, 1996).

Table A-2. National expenditures for the performance of R&D as a percent of GDP: 1975–96

Year	GDP		R&D as a percent of GDP	
	Japan	United States	Japan	United States
	[Millions of constant 1987 dollars 1/]		[Percent]	
1975.....	\$984,819	\$3,224,029	1.9%	2.2%
1976.....	1,031,750	3,383,203	1.8	2.2
1977.....	1,080,058	3,533,381	1.8	2.2
1978.....	1,142,273	3,703,251	1.8	2.2
1979.....	1,201,690	3,796,537	1.9	2.2
1980.....	1,254,549	3,776,377	2.0	2.3
1981.....	1,332,408	3,843,013	2.1	2.4
1982.....	1,375,753	3,760,255	2.2	2.5
1983.....	1,411,938	3,906,666	2.4	2.6
1984.....	1,471,871	4,148,490	2.4	2.7
1985.....	1,545,840	4,279,676	2.6	2.8
1986.....	1,585,623	4,404,292	2.6	2.8
1987.....	1,651,093	4,539,930	2.6	2.8
1988.....	1,754,598	4,718,710	2.7	2.7
1989.....	1,837,158	4,839,447	2.8	2.7
1990.....	1,950,218	4,895,057	2.9	2.7
1991.....	2,026,702	4,868,027	2.8	2.8
1992.....	2,049,410	4,979,487	2.8	2.7
1993.....	2,051,471	5,136,275	2.7	2.6
1994.....	2,061,268	5,343,695	2.6	2.5
1995.....	2,079,285	5,520,671	NA	2.5
1996.....	2,126,761	5,670,229	NA	2.5

1/ Conversion of Japanese yen to U.S. dollars is calculated with purchasing power parity exchange rates from the Organisation for Economic Co-operation and Development.

KEY: NA = not available

NOTES: R&D data for Japan are based on OECD's "adjusted series" for Japan, for better international comparability. (See Methodology and Notes on Data Series.) Constant 1987 dollars for the United States are based on U.S. Department of Commerce calendar year GDP implicit price deflators.

SOURCES: For Japan, 1981–94 data: Organisation for Economic Co-operation and Development, Main Science and Technology Indicators (MSTI), Paris, OECD, December 1996; for earlier data for Japan, 1975–80, OECD/MSTI 1990, special tabulations; for the United States, Science Resources Studies Division, National Science Foundation, *National Patterns of R&D Resources: 1996*, NSF 96-333 (Arlington, VA: NSF, 1996).

Table A-3. Estimated nondefense R&D expenditures as a percent of GDP: 1975–96

Year	Total		Government	
	Japan	United States	Japan	United States
	[Millions of constant 1987 dollars ^{1/}]			
1981.....	\$28,254	\$68,021	\$6,909	\$19,242
1982.....	30,394	68,813	7,001	16,974
1983.....	32,981	72,273	7,069	16,869
1984.....	35,544	77,992	7,113	16,979
1985.....	39,638	83,454	7,342	18,100
1986.....	40,263	84,562	7,558	17,209
1987.....	43,065	85,805	8,158	18,343
1988.....	46,527	89,184	8,101	18,581
1989.....	49,603	93,885	8,196	19,181
1990.....	55,205	99,859	8,491	20,312
1991.....	56,561	105,636	8,851	20,658
1992.....	55,923	106,561	9,331	20,326
1993.....	54,366	104,780	10,235	19,956
1994.....	53,723	106,874	9,988	21,309
1995 (prelim.).....	NA	112,622	10,138	22,073
1996 (prelim.).....	NA	NA	11,530	NA
[Percent]				
1981.....	2.1%	1.8%	0.52%	0.50%
1982.....	2.2	1.8	0.5	0.5
1983.....	2.3	1.9	0.5	0.4
1984.....	2.4	1.9	0.5	0.4
1985.....	2.6	2.0	0.5	0.4
1986.....	2.5	1.9	0.5	0.4
1987.....	2.6	1.9	0.5	0.4
1988.....	2.7	1.9	0.5	0.4
1989.....	2.7	1.9	0.5	0.4
1990.....	2.8	2.0	0.4	0.4
1991.....	2.8	2.2	0.4	0.4
1992.....	2.7	2.1	0.5	0.4
1993.....	2.7	2.0	0.5	0.4
1994.....	2.6	2.0	0.5	0.4
1995 (prelim.).....	NA	2.0	0.5	0.4
1996 (prelim.).....	NA	NA	0.5	NA

1/ Conversion of Japanese yen to U.S. dollars is calculated with purchasing power parity exchange rates from the Organisation for Economic Co-operation and Development.

KEY: NA = not available

NOTES: R&D data for Japan are based on OECD's "adjusted series" for Japan, for better international comparability. (See Methodology and Notes on Data Series.) Data are preliminary for 1995 and 1996. Constant 1987 dollars for the United States are based on U.S. Department of Commerce GDP implicit price deflators.

SOURCES: For Japan, 1981–94, Organisation for Economic Co-operation and Development, Main Science and Technology Indicators (MSTI), Paris, OECD, December 1996; preliminary 1995–96 government data for Japan from Science and Technology Agency (STA) calculations, in National Science Foundation, Tokyo Office, Report Memorandum #96-5, February 2, 1996; for the United States, Science Resources Studies Division, National Science Foundation, *National Patterns of R&D Resources: 1996*, NSF 96-333 (Arlington, VA: NSF, 1996).

Table A-4. National R&D funding by source: 1975–97

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Year	Japan			United States		
	Government	Industry	Univ. & private non-profit	Government	Industry	Univ. & private non-profit
[Millions of constant 1987 dollars 1/]						
1975.....	\$4,785	\$11,391	\$1,388	\$37,396	\$32,161	\$2,679
1976.....	4,958	11,919	1,437	38,464	33,837	2,743
1977.....	5,156	12,445	1,324	38,793	35,117	2,810
1978.....	5,535	13,024	1,528	39,819	37,234	3,017
1979.....	6,242	14,634	1,518	41,157	39,762	3,142
1980.....	6,749	16,687	1,484	41,385	43,118	3,146
1981.....	7,077	19,242	2,103	42,629	45,563	3,217
1982.....	7,186	21,161	2,263	43,702	48,559	3,280
1983.....	7,266	23,457	2,455	46,881	51,896	3,509
1984.....	7,331	25,856	2,575	50,188	57,368	3,645
1985.....	7,625	29,541	2,755	55,246	61,418	3,937
1986.....	7,872	29,905	2,800	55,968	63,009	4,343
1987.....	8,510	31,911	2,996	57,914	62,643	4,819
1988.....	8,492	35,376	3,050	57,228	65,492	5,111
1989.....	8,628	39,596	3,184	55,188	69,169	5,534
1990.....	8,964	43,373	3,341	54,452	73,604	5,943
1991.....	9,359	44,171	3,538	51,322	78,652	6,326
1992.....	9,883	42,921	3,614	49,962	79,757	6,477
1993.....	10,827	40,339	3,902	48,956	78,306	6,518
1994.....	10,594	39,877	3,857	47,918	78,802	6,763
1995.....	10,806	NA	NA	48,859	83,702	6,847
1996.....	12,198	NA	NA	47,416	86,611	6,867
1997.....	13,053	NA	NA	NA	NA	NA

See explanatory information and SOURCE at end of table.

Table A-4. National R&D funding by source: 1975–97

Page 2 of 2

Year	Japan			United States		
	Government	Industry	Univ. & private non-profit	Government	Industry	Univ. & private non-profit
[Percent]						
1977.....	26.3%	62.7%	7.6%	51.4%	44.5%	3.7%
1977.....	26.4	63.7	6.8	50.5	45.8	3.7
1978.....	26.6	62.6	7.3	49.6	46.5	3.8
1979.....	27.3	64.0	6.6	48.8	47.3	3.7
1980.....	26.8	66.2	5.9	47.1	49.2	3.6
1981.....	24.9	67.7	7.4	46.5	49.8	3.5
1982.....	23.5	69.2	7.4	45.7	50.8	3.4
1983.....	21.9	70.7	7.4	45.8	50.7	3.4
1984.....	20.5	72.3	7.2	45.1	51.6	3.3
1985.....	19.1	74.0	6.9	45.8	50.9	3.3
1986.....	19.4	73.7	6.9	45.4	51.1	3.5
1987.....	19.6	73.5	6.9	46.2	50.0	3.8
1988.....	18.1	75.4	6.5	44.7	51.2	4.0
1989.....	16.8	77.1	6.2	42.5	53.3	4.3
1990.....	16.1	77.9	6.0	40.5	54.9	4.4
1991.....	16.4	77.4	6.2	37.6	57.7	4.6
1992.....	17.5	76.0	6.4	36.6	58.6	4.8
1993.....	19.7	73.4	7.1	36.5	58.5	4.9
1994.....	19.5	73.4	7.1	35.8	59.0	5.1
1995.....	NA	NA	NA	35.0	60.0	4.9
1996.....	NA	NA	NA	33.6	61.5	4.9

1/ Conversion of Japanese yen to U.S. dollars is calculated with purchasing power parity exchange rates from the Organisation for Economic Co-operation and Development.

KEY: NA = not available

NOTES: R&D data for Japan are based on OECD's "adjusted series" for Japan, for better international comparability. (See Methodology and Notes on Data Series.) U.S. data are preliminary for 1995 and 1996. Constant 1987 dollars for the United States are based on U.S. Department of Commerce GDP implicit price deflators. Japanese government data for 1995–96 are budget allocation data, not R&D expenditure data. The 1995 government R&D figure does not include the subsequent supplemental budget. Japan's 1997 government data are the Cabinet-approved budget, awaiting Diet approval.

SOURCES: For Japan, 1981–94 data: Organisation for Economic Co-operation and Development, Main Science and Technology Indicators (MSTI), Paris, OECD, December 1996; for earlier data for Japan, 1975–80, OECD/MSTI 1990, special tabulations; for the United States, Science Resources Studies Division, National Science Foundation, *National Patterns of R&D Resources: 1996*, NSF 96-333 (Arlington, VA: NSF, 1996).

Table A-5. National R&D expenditures, by performer: 1975-96

Page 1 of 2

Year	Japan				United States			
	Government	Industry	Universities & colleges	Non-profit research inst	Government	Industry	Universities & colleges 2/	Non-profit research inst
[Millions of constant 1987 dollars 1/]								
1975.....	\$2,311	\$11,186	\$3,428	\$945	\$11,248	\$49,161	\$9,236	\$2,593
1976.....	2,395	11,659	3,640	1,003	11,268	51,620	9,525	2,631
1977.....	2,463	12,274	3,664	879	10,852	53,354	9,839	2,674
1978.....	2,704	12,803	3,982	1,020	11,426	55,231	10,641	2,773
1979.....	2,956	14,455	4,218	915	11,465	58,271	11,285	3,040
1980.....	3,108	16,413	4,304	1,008	10,810	62,071	11,769	2,999
1981.....	3,411	18,748	4,573	1,279	10,830	65,665	11,997	2,915
1982.....	3,425	20,535	4,821	1,407	10,934	69,988	11,725	2,894
1983.....	3,451	22,851	5,153	1,394	12,163	74,849	12,206	3,068
1984.....	3,541	25,156	5,210	1,502	12,730	82,198	12,948	3,324
1985.....	3,912	28,657	5,188	1,677	13,727	89,236	14,009	3,628
1986.....	3,977	29,002	5,316	1,907	13,939	90,633	15,255	3,483
1987.....	4,472	30,775	5,732	2,084	13,413	92,155	16,358	3,450
1988.....	4,410	34,104	5,856	2,158	13,625	93,373	17,368	3,465
1989.....	4,417	38,180	6,082	2,311	13,886	94,060	18,213	3,733
1990.....	4,454	42,026	6,378	2,450	14,151	96,846	18,637	4,148
1991.....	4,623	43,023	6,451	2,511	12,972	99,449	19,266	4,464
1992.....	5,026	41,530	6,803	2,654	12,975	98,519	19,897	4,673
1993.....	5,496	39,065	7,273	2,693	13,547	95,061	20,433	4,656
1994 3/.....	5,270	38,639	7,252	2,771	12,870	94,841	20,898	4,758
1995.....	NA	NA	NA	NA	12,843	100,390	21,295	4,797
1996.....	NA	NA	NA	NA	12,442	102,443	21,221	4,656

See explanatory information and SOURCE at end of table.

Table A-5. National R&D expenditures, by performer: 1975-96

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Year	Japan				United States			
	Government	Industry	Universities & colleges	Non-profit research inst	Government	Industry	Universities & colleges 2/	Non-profit research inst
[Percent]								
1977.....	12.6%	62.8%	18.7%	4.5%	14.1%	69.5%	12.8%	3.5%
1978.....	13.0	61.5	19.1	4.9	14.3	69.0	13.3	3.5
1979.....	12.9	63.2	18.4	4.0	13.6	69.3	13.4	3.6
1980.....	12.3	65.1	17.1	4.0	12.3	70.8	13.4	3.4
1981.....	12.0	66.0	17.6	4.5	11.8	71.8	13.1	3.2
1982.....	11.2	67.2	17.1	4.6	11.4	73.3	12.3	3.0
1983.....	10.4	68.9	16.5	4.2	11.9	73.2	11.9	3.0
1984.....	9.9	70.3	15.5	4.2	11.4	73.9	11.6	3.0
1985.....	9.8	71.8	14.2	4.2	11.4	74.0	11.6	3.0
1986.....	9.8	71.5	14.0	4.7	11.3	73.5	12.4	2.8
1987.....	10.3	70.9	14.0	4.8	10.7	73.5	13.0	2.8
1988.....	9.4	72.7	13.3	4.6	10.7	73.0	13.6	2.7
1989.....	8.6	74.3	12.5	4.5	10.7	72.4	14.0	2.9
1990.....	8.0	75.5	12.2	4.4	10.6	72.3	13.9	3.1
1991.....	8.1	75.4	12.1	4.4	9.5	73.0	14.1	3.3
1992.....	8.9	73.5	12.8	4.7	9.5	72.3	14.6	3.4
1993.....	10.0	71.1	14.0	4.9	10.1	71.1	15.3	3.5
1994.....	9.7	71.1	14.3	5.1	9.6	71.1	15.7	3.6
1995.....	NA	NA	NA	NA	9.2	72.0	15.3	3.4
1996.....	NA	NA	NA	NA	8.8	72.7	15.1	3.3

1/ Conversion of Japanese yen to U.S. dollars is calculated with purchasing power parity exchange rates from the Organisation for Economic Co-operation and Development.

2/ In the U.S. data, universities and colleges include federally funded research and development centers (FFRDCs).

3/ In the Japanese data, performance by universities and non-profit institutes is estimated for 1994.

KEY: NA = not available

NOTES: R&D data for Japan are based on OECD's "adjusted series" for Japan, for better international comparability (See Methodology and Notes on Data Series). U.S. data are preliminary for 1995 and 1996. Constant 1987 dollars for the United States are based on U.S. Department of Commerce GDP implicit price deflators. Japanese government data for 1995-97 are budget allocation data, not R&D expenditure data.

SOURCES: For Japan, 1981-94 data: Organisation for Economic Co-operation and Development, Main Science and Technology Indicators (MSTI). Paris, OECD, Dec., 1996; for earlier data for Japan, 1975-80, OECD/MSTI 1990, special tabulations; for the United States, Science Resources Studies Division, National Science Foundation, *National Patterns of R&D Resources: 1996*, NSF 96-333 (Arlington, VA: NSF, 1996).

Table A-6. R&D Expenditures in Selected Countries by Characteristic of Work: 1980–93

Year	United States				Japan			
	Basic Research	Applied Research	Development	Total	Basic Research	Applied Research	Development	Total
	[Millions of constant 1987 dollars 1/]							
1980.....	\$11,902	\$19,078	\$56,669	\$87,649	\$3,882	\$6,403	\$15,125	\$25,411
1981.....	12,303	20,825	58,280	91,408	4,149	7,304	16,996	28,450
1982.....	12,480	21,674	61,387	95,541	4,495	7,920	18,195	30,610
1983.....	13,377	23,252	65,657	102,286	4,844	8,427	19,940	33,212
1984.....	14,223	24,607	72,371	111,201	5,042	8,976	21,743	35,762
1985.....	15,066	26,836	78,698	120,600	5,349	9,980	24,631	39,960
1986.....	17,121	27,933	78,266	123,320	5,599	9,900	25,116	40,615
1987.....	18,025	27,687	79,664	125,376	6,295	10,550	26,571	43,416
1988.....	18,351	28,145	81,334	127,830	6,474	11,354	29,088	46,916
1989.....	19,549	29,726	80,616	129,891	6,830	12,274	32,251	51,355
1990.....	19,789	30,756	83,445	133,990	7,238	13,474	34,965	55,677
1991.....	22,513	32,886	80,902	136,301	7,642	14,135	35,682	57,459
1992.....	22,212	31,324	82,661	136,197	7,799	13,886	35,113	56,798
1993.....	22,719	30,162	80,901	133,782	NA	NA	NA	NA
1994.....	22,923	29,067	81,495	133,485	NA	NA	NA	NA
1995.....	22,987	29,309	87,112	139,408	NA	NA	NA	NA
1996.....	22,814	29,634	88,445	140,893	NA	NA	NA	NA
[Percent]								
1980.....	13.6%	21.8%	64.7%	100%	15.4%	25.3%	59.3%	100%
1981.....	13.5	22.8	63.8	100	14.6	25.6	59.8	100
1982.....	13.1	22.7	64.3	100	14.7	25.8	59.5	100
1983.....	13.1	22.7	64.2	100	14.6	25.3	60.1	100
1984.....	12.8	22.1	65.1	100	14.1	25.1	60.8	100
1985.....	12.5	22.3	65.3	100	13.4	24.9	61.7	100
1986.....	13.9	22.7	63.5	100	13.8	24.4	61.9	100
1987.....	14.4	22.1	63.5	100	14.5	24.3	61.2	100
1988.....	14.4	22.0	63.6	100	13.8	24.2	62.0	100
1989.....	15.1	22.9	62.1	100	13.3	23.9	62.8	100
1990.....	14.8	23.0	62.3	100	13.0	24.2	62.8	100
1991.....	16.5	24.1	59.4	100	13.3	24.6	62.1	100
1992.....	16.3	23.0	60.7	100	13.9	24.4	61.7	100
1993.....	17.0	22.5	60.5	100	NA	NA	NA	NA
1994.....	17.2	21.8	61.1	100	NA	NA	NA	NA
1995.....	16.5	21.0	62.5	100	NA	NA	NA	NA
1996.....	16.2	21.0	62.8	100	NA	NA	NA	NA

1/ Conversion of Japanese yen to U.S. dollars is calculated with purchasing power parity exchange rates from the Organisation for Economic Co-operation and Development.

KEY: NA = not applicable

NOTES: U.S. data are preliminary for 1995 and 1996. Constant 1987 dollars for the United States are based on U.S. Department of Commerce GDP implicit price deflators.

SOURCES: For Japan, Government of Japan, National Institute of Science and Technology Policy, Science and Technology Agency, *Science and Technology Indicators: 1994*, NISTEP Report No. 37 (Tokyo, 1995); for the United States, Science Resources Studies Division, National Science Foundation, *National Patterns of R&D Resources: 1996*, NSF 96-333 (Arlington, VA: NSF, 1996).

Table A-7. Scientists and engineers engaged in R&D: 1975–94

Year	Japan	United States	Japan	United States
			Per 10,000 labor force	
1975.....	253,488	527,400	45.5	55.3
1976.....	263,486	535,200	47.1	54.7
1977.....	265,174	560,600	47.1	55.7
1978.....	273,190	586,600	48.3	56.5
1979.....	290,827	614,500	51.2	57.7
1980.....	303,524	651,100	53.2	60.0
1981.....	310,993	683,300	54.0	61.9
1982.....	320,991	711,900	56.0	63.6
1983.....	347,420	751,700	59.0	66.4
1984.....	357,416	797,800	60.0	69.2
1985.....	380,761	801,900	64.0	68.4
1986.....	392,981	838,992	65.0	70.2
1987.....	415,553	877,800	68.0	72.2
1988.....	434,643	900,701	70.0	73.0
1989.....	457,522	924,200	73.0	73.6
1990.....	477,866	942,126	75.0	74.5
1991.....	491,102	960,400	75.0	75.7
1992.....	511,407	961,549	78.0	75.0
1993.....	526,501	962,700	80.0	74.3
1994.....	541,015	NA	NA	NA

KEY: NA = not available

NOTES: Japanese data are based on OECD's "adjusted series" for Japan and include persons primarily employed in R&D in the natural sciences and engineering. (See Methodology and Notes on Data Series.) The U.S. data are a mix of S&Es engaged in R&D on an FTE basis and counts of S&Es whose primary work activity is R&D. U.S. data are imputed for 1986, 1988, 1990, and 1992.

SOURCES: For Japan, 1981–94 data: Organisation for Economic Co-operation and Development, *Main Science and Technology Indicators (MSTI)*, Paris, OECD, December 1996; for earlier data for Japan, 1975–80, OECD/MSTI 1990, special tabulations; for the United States, Science Resources Studies Division, National Science Foundation, *National Patterns of R&D Resources: 1996*, NSF 96-333 (Arlington, VA: NSF, 1996).

Table A-8. Distribution of government R&D funding by objective: selected years

Objective	Japan			United States		
	1985	1989	1994	1985	1989	1994
	[Percent]					
Agriculture, forestry, and fisheries.....	11.3%	3.7%	3.5%	2.1%	1.9%	1.8%
Industrial development.....	5.9	4.6	3.7	0.2	0.2	0.1
Energy.....	16.3	22.2	20.5	4.8	3.9	4.2
Health.....	2.6	2.7	3.0	11.2	12.9	16.1
Advancement of knowledge.....	47.3	51.1	51.2	3.7	3.8	4.0
Advancement of research.....	NA	7.8	9.1	3.7	3.8	4.0
GUF.....	NA	43.3	42.1	NA	NA	NA
Civil space.....	6.8	6.4	7.5	5.5	7.3	10.9
Defense.....	4.1	5.1	6.5	67.5	65.5	55.3
All others.....	5.7	4.2	4.6	5.0	4.5	3.6

KEY: NA = not available

SOURCES: Government of Japan, National Institute of Science and Technology Policy, Science and Technology Agency, *Science and Technology Indicators: 1994*, NISTEP Report No. 37 (Tokyo, 1995); Science Resources Studies Division, National Science Foundation, *National Patterns of R&D Resources: 1996*, NSF 96-333 (Arlington, VA: NSF, 1996).

Table A-9. Distribution of Japanese Government R&D budget among key Japanese ministries and agencies: selected years

Ministry/agency	1990	1994	1997 1/	1990	1994	1997
	[Million of constant 1987 dollars]			[Percent]		
Total 2/.....	\$8,711	\$9,977	\$12,779	100%	100%	100%
Ministry of Education, Science, and Culture.....	4,056	4,896	5,508	47	49	43
Science and Technology Agency.....	2,244	2,560	3,102	26	26	24
Ministry of International Trade and Industry.....	1,141	1,200	1,974	13	12	15
Ministry of Agriculture, Forestry, and Fisheries.....	318	350	416	4	4	3
Defense Agency.....	473	596	744	5	6	6
Ministry of Health and Welfare.....	232	296	379	3	3	3
All others.....	247	79	639	3	1	5

1/ 1997 approved government budget for science and technology.

2/ Does not include local government funding of R&D.

SOURCES: Government of Japan, National Institute of Science and Technology Policy, Science and Technology Agency (STA), *Science and Technology Indicators: 1994*, MISTEP Report No. 37 (Tokyo, 1996) and STA, "Science and Technology Budget of the Government for FY1997" (Draft).

Table A-10. R&D performance by industry

Page 1 of 2

Industry	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
	United States [Millions of constant 1987 dollars]												
Total business enterprise.....	\$65,699	\$70,021	\$74,883	\$82,153	\$89,265	\$90,614	\$92,155	\$93,418	\$94,060	\$96,846	\$99,449	\$98,519	95,000
Total manufacturing.....	63,282	67,070	71,054	76,766	82,150	82,931	84,311	83,295	81,128	78,494	75,260	74,588	70,538
Food, beverages, and tobacco.....	809	930	949	1,188	1,204	1,327	1,206	1,176	1,172	1,253	1,086	1,146	1,122
Textiles, apparel, and leather.....	147	162	172	199	231	254	243	249	239	263	253	241	236
Wood products and furniture.....	204	190	174	157	156	149	137	165	181	217	188	216	211
Paper, paper products, and printing.....	718	676	634	651	610	558	604	754	828	1,063	1,106	1,089	1,066
Chemicals, except drugs and medicines.....	4,489	4,909	4,901	5,061	5,358	5,350	5,535	5,616	5,771	6,182	6,452	6,151	6,022
Drugs and medicines.....	2,644	2,975	3,343	3,646	3,692	3,774	4,100	5,041	5,353	5,549	6,004	6,571	6,432
Petroleum refineries and products.....	2,455	2,556	2,591	2,539	2,352	2,082	1,897	1,923	2,009	2,035	2,124	1,883	1,844
Rubber and plastic products.....	982	921	890	865	716	744	607	720	813	1,021	1,107	1,158	1,134
Non-metallic mineral products.....	583	612	716	805	884	980	995	706	585	545	433	446	436
Basic metal industries.....	1,113	1,178	1,245	787	784	829	730	613	632	652	607	432	423
Metal products.....	791	746	804	925	878	923	783	848	833	829	828	841	823
Non-electrical machinery.....	3,065	2,878	2,744	2,641	2,537	2,472	2,428	2,744	2,616	2,430	3,023	2,923	2,862
Office and computing machinery.....	5,581	6,766	7,613	8,896	10,408	10,105	9,347	9,935	10,717	10,320	9,541	9,433	9,234
Electrical machinery, except communication equipment	4,408	3,412	3,230	2,030	1,353	1,290	1,239	1,064	960	925	892	864	846
Radio, TV, and communication equipment.....	8,690	9,629	11,319	13,103	13,940	14,166	14,609	12,541	11,315	10,902	10,515	10,187	9,972
Shipbuilding and repairing.....	0	0	0	0	0	0	0	0	0	0	0	0	0
Motor vehicles.....	6,094	5,727	6,101	6,652	7,401	10,042	9,279	9,711	10,157	9,052	8,833	8,208	8,036
Aircraft.....	15,176	17,253	17,676	20,712	23,557	21,719	24,458	23,272	20,582	18,213	14,140	14,192	13,893
Other transport equipment.....	186	238	437	438	393	508	509	502	468	415	350	341	334
Professional goods.....	4,583	4,692	4,894	5,054	5,312	5,265	5,222	5,325	5,523	6,227	7,402	7,892	7,726
Other manufacturing, nec.....	563	619	621	416	382	394	383	390	373	402	375	374	366
Total services.....	2,417	2,951	3,829	5,387	7,115	7,683	7,844	10,123	12,932	18,352	24,189	23,931	24,462
Electricity, gas, and water.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	242	236
Construction.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Transport and storage.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Communications.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4,391	4,299
Commercial and engineering services.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other services.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

See explanatory information and SOURCE at end of table.

Table A-10. R&D performance by industry

Page 2 of 2

Industry	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
	Japan [Millions of constant 1987 dollars]												
Total business enterprise.....	18,748	20,535	22,851	25,156	28,657	29,002	30,775	34,104	38,180	42,026	43,318	41,851	39,252
Total manufacturing.....	17,916	19,695	21,882	24,088	27,606	27,942	29,698	32,847	36,789	40,364	41,694	40,063	37,470
Food, beverages, and tobacco.....	515	580	600	652	703	759	916	923	1,017	1,068	1,003	1,015	1,089
Textiles, apparel, and leather.....	333	264	256	291	302	297	315	344	377	400	408	519	403
Wood products and furniture.....	64	66	103	65	59	74	76	84	139	112	138	120	134
Paper, paper products, and printing.....	107	141	186	210	245	239	261	322	367	391	407	327	315
Chemicals, except drugs and medicines.....	2,060	2,276	2,429	2,730	2,868	3,040	3,389	3,656	3,978	4,085	4,258	4,208	4,042
Drugs and medicines.....	1,128	1,219	1,453	1,446	1,649	1,621	1,804	1,966	2,114	2,340	2,624	2,816	2,728
Petroleum refineries and products.....	210	222	250	274	329	325	333	354	390	417	394	394	355
Rubber and plastic products.....	499	530	549	649	701	712	811	909	1,078	1,041	1,138	1,092	1,033
Non-metallic mineral products.....	434	476	568	643	841	889	843	938	1,027	976	1,155	938	860
Basic metal industries.....	1,226	1,296	1,303	1,370	1,645	1,732	1,657	1,748	1,832	2,015	2,263	2,004	1,884
Metal products.....	334	330	415	409	495	449	449	423	507	588	610	555	522
Non-electrical machinery.....	1,707	1,851	1,984	2,158	2,415	2,398	2,522	2,671	3,125	3,635	3,732	3,486	3,475
Office and computing machinery.....	717	829	1,008	1,488	1,670	1,763	2,212	2,847	3,769	4,060	4,144	3,607	3,477
Electrical machinery, except communication equipment.....	1,766	1,961	2,293	2,636	2,973	2,936	3,155	3,504	4,018	4,518	4,491	4,235	4,208
Radio, TV, and communication equipment.....	3,097	3,707	4,209	4,493	5,433	5,260	5,554	6,065	6,138	6,584	6,956	6,984	6,145
Shipbuilding and repairing.....	42	47	58	44	53	39	42	45	54	59	65	84	79
Motor vehicles.....	2,583	2,754	2,884	3,262	3,670	3,787	3,753	4,348	4,970	5,798	5,620	5,546	4,633
Aircraft.....	127	139	221	112	184	256	280	231	287	361	472	289	305
Other transport equipment.....	138	138	131	120	173	175	99	72	78	78	77	75	76
Professional goods.....	655	682	796	820	973	944	968	1,128	1,234	1,523	1,396	1,432	1,394
Other manufacturing, nec.....	174	187	187	218	222	249	259	268	288	315	344	339	314
Total services.....	740	739	862	955	926	939	956	1,087	1,256	1,477	1,419	1,629	1,625
Electricity, gas, and water.....	272	247	284	316	306	329	308	347	349	441	403	481	477
Construction.....	376	410	508	569	535	574	608	701	859	964	910	1,066	1,076
Transport and storage.....	92	91	78	76	90	33	40	36	45	71	106	81	73
Communications.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Commercial and engineering services.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other services.....	7	NA											

KEY: NA = not available

NOTE: Categories are taken from international Standard Industrial Classification, revision 2.

SOURCES: Organization for Economic Co-operation and Development (OECD), Structural Analysis Database for Industrial Analysis, Analytical Business Enterprise R&D (STAN/ANBERD) file (Paris: OECD, 1995); OECD, Main Science and Technology Indicators database (Paris, 1995).

Table A-11. Industrial R&D expenditures as a percent of GDP: 1975–95

Year	Japanese industrial R&D	U.S. total industrial R&D	U.S. company- supported R&D
	[Percent]		
1975.....	1.2%	1.5%	1.0%
1976.....	1.2	1.5	1.0
1977.....	1.2	1.5	1.0
1978.....	1.1	1.5	1.0
1979.....	1.2	1.5	1.0
1980.....	1.3	1.6	1.1
1981.....	1.4	1.7	1.2
1982.....	1.5	1.9	1.3
1983.....	1.7	1.9	1.3
1984.....	1.8	2.0	1.4
1985.....	1.9	2.1	1.4
1986.....	1.9	2.1	1.4
1987.....	1.9	2.0	1.4
1988.....	2.0	2.0	1.4
1989.....	2.2	1.9	1.4
1990.....	2.2	2.0	1.5
1991.....	2.2	2.0	1.6
1992.....	2.1	2.0	1.6
1993.....	2.0	1.9	1.5
1994.....	1.9	1.8	1.5
1995.....	NA	1.8	1.5

NA = not available

SOURCES: For Japan, 1981–94 data: Organisation for Economic Co-operation and Development, *Main Science and Technology Indicators (MSTI)*, Paris, OECD, December 1996; for earlier data for Japan, 1975–80, OECD/MSTI 1990, special tabulations; for the United States, Science Resources Studies Division, National Science Foundation, *National Patterns of R&D Resources: 1996*, NSF 96-333 (Arlington, VA: NSF, 1996).

Table A-12. Proportion of R&D expenditures, by industry: 1993

Industry	Japan	U.S.
	[Percent]	
Food, beverages, and tobacco.....	2.8%	1.2%
Textiles, apparel, and leather.....	1.0	0.2
Wood products and furniture.....	0.3	0.2
Paper, paper products, and printing.....	0.8	1.1
Chemicals, except drugs and medicines.....	10.3	6.2
Drugs and medicines.....	6.9	6.7
Petroleum refineries and products.....	0.9	1.9
Rubber and plastic products.....	2.6	1.2
Non-metallic mineral products.....	2.2	0.5
Basic metal industries.....	4.8	0.4
Metal products.....	1.3	0.9
Non-electrical machinery.....	8.9	3.0
Office and computing machinery.....	8.9	9.6
Electrical machinery, except communication equipment.....	10.7	0.9
Radio, TV, and communication equipment.....	15.7	10.3
Shipbuilding and repairing.....	0.2	0.0
Motor vehicles.....	11.8	8.3
Aircraft.....	0.8	14.4
Other transport equipment.....	0.2	0.3
Professional goods.....	3.6	8.0
Other manufacturing, nec.....	0.8	0.4
Total services.....	4.1	24.3
Electricity, gas, and water.....	1.2	0.2
Construction.....	2.7	0.0
Transport and storage.....	0.2	0.0
Communications.....	0.0	4.5
Commercial and engineering services.....	0.0	0.0
Other services.....	0.0	0.0

SOURCES: Organization for Economic Co-operation and Development (OECD), Structural Analysis Database for Industrial Analysis, Analytical Business Enterprise R&D (STAN/ANBERD) file (Paris, OECD, 1995).

Table A-13. R&D expenditures as a percent of net sales: 1981-93

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Industry	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
	United States												
	[Percent]												
Total manufacturing.....	2.5%	2.9%	3.0%	3.1%	3.4%	3.5%	3.4%	3.2%	3.1%	3.1%	3.1%	3.1%	2.8%
Food, beverages, and tobacco.....	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3
Textiles, apparel, and leather.....	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Wood products and furniture.....	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Paper, paper products, and printing.....	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5
Chemicals, except drugs and medicines.....	1.6	1.9	1.8	1.8	1.9	1.9	1.8	1.7	1.8	1.9	2.0	1.9	2.3
Drugs and medicines.....	9.5	10.2	10.6	11.4	11.0	10.4	10.6	12.0	11.9	11.8	11.5	11.9	13.2
Petroleum refineries and products.....	0.9	1.0	1.2	1.2	1.2	1.6	1.5	1.5	1.5	1.3	1.6	1.5	1.5
Rubber and plastic products.....	1.5	1.4	1.3	1.1	0.9	1.0	0.7	0.8	0.9	1.1	1.3	1.2	1.0
Non-metallic mineral products.....	1.0	1.2	1.3	1.3	1.5	1.6	1.7	1.2	1.0	1.0	0.8	0.9	1.0
Basic metal industries.....	0.6	1.0	1.0	0.6	0.7	0.8	0.6	0.4	0.4	0.5	0.5	0.4	0.5
Metal products.....	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Non-electrical machinery.....	1.5	1.7	1.8	1.6	1.6	1.6	1.5	1.6	1.5	1.4	1.9	1.9	1.6
Office and computing machinery.....	12.4	13.7	14.3	14.2	17.1	18.6	17.3	17.1	19.4	20.2	21.0	19.8	8.1
Electrical machinery, except communication equipment.....	7.8	7.1	6.5	3.5	2.3	2.2	1.7	1.3	1.2	1.3	1.3	1.3	1.0
Radio, TV, and communication equipment.....	11.5	12.6	13.8	13.1	13.7	13.7	15.8	12.7	11.6	11.3	10.8	9.8	8.6
Shipbuilding and repairing.....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Motor vehicles.....	4.1	4.3	3.5	3.3	3.6	4.9	4.5	4.5	4.8	4.7	5.0	4.2	4.0
Aircraft.....	18.0	20.3	20.2	21.7	23.3	20.2	22.4	21.3	18.0	16.1	12.5	13.6	13.3
Professional goods.....	4.4	4.6	4.8	4.4	4.9	4.7	4.9	4.9	5.1	5.7	6.9	7.4	7.8
Other manufacturing, nec.....	1.6	1.8	1.9	1.3	1.3	1.3	1.2	1.1	1.0	1.1	1.1	1.1	1.1

See explanatory information and SOURCE at end of table.

Table A-13. R&D expenditures as a percent of net sales: 1981–93

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Industry	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
	Japan												
	[Percent]												
Total manufacturing.....	1.3%	1.5%	1.6%	1.7%	1.9%	2.1%	2.2%	2.3%	2.4%	2.5%	2.5%	2.5%	2.5%
Food, beverages, and tobacco.....	0.4	0.4	0.4	0.4	0.4	0.5	0.6	0.6	0.6	0.7	0.6	0.6	0.7
Textiles, apparel, and leather.....	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.8	0.7
Wood products and furniture.....	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.4	0.3	0.4	0.3	0.4
Paper, paper products, and printing.....	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.3
Chemicals, except drugs and medicines.....	1.5	1.6	1.7	1.9	2.0	2.3	2.5	2.6	2.7	2.6	2.7	2.8	2.8
Drugs and medicines.....	5.7	5.8	6.7	6.9	7.8	7.3	7.5	7.7	7.9	8.6	9.8	10.3	9.9
Petroleum refineries and products.....	0.2	0.2	0.3	0.4	0.5	0.7	0.9	1.0	1.0	0.9	0.9	0.9	0.9
Rubber and plastic products.....	1.0	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.5	1.4	1.5	1.5	1.5
Non-metallic mineral products.....	1.0	1.1	1.4	1.5	2.0	2.2	2.1	2.2	2.3	2.1	2.4	2.1	2.0
Basic metal industries.....	0.7	0.7	0.8	0.8	1.0	1.2	1.2	1.1	1.1	1.2	1.3	1.4	1.4
Metal products.....	0.7	0.7	0.9	0.8	0.9	0.8	0.8	0.7	0.8	0.8	0.8	0.7	0.7
Non-electrical machinery.....	1.5	1.7	2.0	2.0	2.2	2.3	2.7	2.4	2.5	2.6	2.6	2.7	3.0
Office and computing machinery.....	3.4	3.6	3.5	4.2	4.3	4.6	5.5	6.5	7.7	7.6	7.3	6.8	7.1
Electrical machinery, except communication equipment.....	3.1	3.4	3.7	3.8	4.0	3.9	4.0	4.1	4.3	4.6	4.2	4.2	4.6
Radio, TV, and communication equipment.....	4.1	4.8	4.7	3.9	4.8	4.7	5.0	4.9	4.6	4.8	4.8	5.5	5.1
Shipbuilding and repairing.....	0.3	0.3	0.4	0.3	0.4	0.4	0.6	0.6	0.7	0.6	0.6	0.7	0.7
Motor vehicles.....	2.1	2.3	2.3	2.5	2.6	2.7	2.6	2.8	2.9	3.2	3.0	3.0	2.7
Aircraft.....	7.4	6.6	9.5	4.4	6.1	8.9	8.4	6.7	8.2	10.4	13.7	7.7	8.1
Other transport equipment.....	3.1	3.6	3.5	3.3	4.9	5.2	3.0	2.1	2.0	1.8	1.8	1.5	1.8
Professional goods.....	3.4	3.8	4.5	4.4	4.7	4.8	5.2	5.6	5.8	6.8	5.9	6.8	7.6
Other manufacturing, nec.....	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.4

SOURCE: Organization for Economic Co-operation and Development (OECD), Structural Analysis Database for Industrial Analysis, Analytical Business Enterprise R&D (STANBERD) file and Net sales file (Paris: OECD, 1996).

**Table A-14. Number of industrial scientists and engineers engaged in R&D:
1975–95**

Year	Japan	United States
1975.....	146,604	361,700
1976.....	145,216	363,900
1977.....	151,437	373,600
1978.....	153,706	393,600
1979.....	157,279	414,200
1980.....	173,244	437,300
1981.....	184,889	498,800
1982.....	192,942	525,400
1983.....	201,137	562,500
1984.....	223,882	603,300
1985.....	231,097	646,800
1986.....	251,771	683,400
1987.....	260,846	702,200
1988.....	279,298	715,600
1989.....	294,202	733,100
1990.....	313,948	758,500
1991.....	330,996	776,400
1992.....	340,809	783,800
1993.....	356,406	764,500
1994.....	367,278	758,800
1995.....	376,639	NA

KEY: NA = not available

NOTE: Japanese data include mainly regular researchers employed in R&D in industry and a tiny fraction (0.4 percent) of external non-regular workers. Assistant research workers and technicians are not included. U.S. data are full time equivalent (FTE) R&D scientists and engineers in R&D performing companies.

SOURCES: For Japanese data 1975–94, Government of Japan, National Institute of Science and Technology Policy, Science and Technology Agency, *Science and Technology Indicators: 1994*, NISTEP Report No. 37 (Tokyo, 1995); for 1995 data, Statistics Bureau, Management and Coordination Agency, *Report on the Survey of Research and Development, 1995*; for the U.S. data for 1984–94, Science Resources Studies Division, National Science Foundation, *National Patterns of R&D Resources: 1996*, (Arlington, VA); for prior years, NSF/SRS *Research and Development in Industry*, annual series.

Table A-15. R&D scientists and engineers per 10,000 employees in manufacturing companies, by industry

Industry	Japan			United States		
	1985	1990	1993	1985	1990	1993
All manufacturing, total.....	468	577	622	430	470	520
Food.....	225	230	235	80	80	90
Textiles.....	213	280	337	50	60	70
Chemicals and allied products.....	784	938	960	570	690	800
Industrial chemicals.....	711	853	884	390	590	580
Drugs and medicines.....	796	875	934	810	960	1,380
Petroleum and coal.....	394	455	427	210	260	270
Rubber.....	363	481	492	260	320	240
Ceramics.....	355	372	450	200	240	210
Iron and steel.....	177	247	262	110	70	90
Non-ferrous metals.....	316	349	371	160	150	150
Fabricated metals.....	260	255	268	NA	200	210
General machinery.....	425	472	508	600	730	610
Electrical machinery.....	767	978	1,018	NA		
Electrical equipment.....	647	770	794	530	660	750
Communications and electronic equipment.....	836	1,094	1,140	620	890	NA
Motor vehicles.....	331	458	517	280	430	540
Professional and scientific instruments.....	664	831	877	NA	710	NA
Aircraft and missiles.....	NA	NA	NA	1,160	960	940

KEY: NA = not available

NOTES: Table uses industry field names as given in National Science Foundation, *Science & Engineering Indicators, 1996*. Japanese data include mainly regular researchers employed in R&D in industry and a tiny fraction (0.4 percent) of external non-regular workers. Assistant research workers and technicians are not included. U.S. data are full time equivalent (FTE) R&D scientists and engineers in R&D performing companies.

SOURCES: Government of Japan, National Institute of Science and Technology Policy, Science and Technology Agency, *Science and Technology Indicators: 1994*, NISTEP Report No. 37 (Tokyo, 1995); and the National Science Foundation, Science Resources Studies Division, *Research and Development in Industry: 1993*, NSF 96-304 (NSF: Arlington, VA, 1996)

Table A-16. First university degrees in science and engineering, by field: 1975–94

Field	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Japan										
Total.....	313,072	326,167	339,819	356,981	374,887	378,666	386,057	382,466	369,069	372,247
Natural science 1/.....	7,014	7,483	7,479	7,985	8,248	8,636	8,651	8,710	8,575	9,054
Mathematics.....	2,490	2,529	2,755	2,703	2,829	2,918	3,152	3,045	3,148	3,180
Agricultural science.....	9,480	9,965	10,455	10,937	12,794	11,182	11,555	11,016	10,658	11,189
Social science.....	134,645	139,258	143,416	151,519	158,023	158,394	160,520	159,450	151,996	151,626
Engineering/computer sci....	66,512	68,126	70,431	72,466	75,409	74,737	76,370	74,774	70,824	71,640
Other.....	92,931	98,806	105,283	111,371	117,584	122,799	125,809	125,471	123,868	125,558
United States										
Total.....	931,663	934,443	928,228	930,197	931,340	940,251	946,877	964,043	980,679	986,345
Natural science 1/.....	70,578	73,258	72,980	71,334	68,489	66,446	63,896	62,619	60,145	59,172
Mathematics.....	18,346	16,085	14,303	12,701	11,901	11,473	11,183	11,708	12,557	13,342
Computer science.....	5,039	5,664	6,426	7,224	8,769	11,213	15,223	20,431	24,682	32,435
Agricultural science.....	16,531	18,289	20,199	21,027	21,631	21,121	20,166	19,235	19,170	17,303
Social science.....	163,147	157,405	148,533	144,018	138,903	135,632	132,607	133,565	128,651	126,078
Engineering.....	39,824	38,790	41,357	47,251	53,469	58,810	63,717	67,460	72,670	76,153
Other.....	618,198	624,952	624,430	626,642	628,178	635,556	640,085	649,025	662,804	661,862
1985										
Japan										
Total.....	373,302	376,260	382,655	382,828	376,688	400,103	428,079	437,878	445,774	461,898
Natural science 1/.....	9,166	9,435	9,817	9,895	9,900	9,866	10,452	10,386	10,757	11,470
Mathematics.....	3,532	3,379	3,572	3,493	3,395	3,554	3,765	3,790	4,221	4,574
Agricultural science.....	10,928	10,991	11,266	10,584	10,252	11,733	12,282	12,284	13,021	13,361
Social science.....	151,072	151,056	150,956	150,819	147,087	157,477	170,721	177,240	179,338	186,580
Engineering/computer sci....	72,560	74,516	77,077	77,503	77,009	81,355	87,397	88,385	88,406	91,184
Other.....	126,044	126,883	129,967	130,534	129,045	136,118	143,462	145,793	150,031	154,739
United States										
Total.....	990,880	1,000,352	1,000,532	1,006,033	1,030,171	1,062,151	1,107,997	1,150,072	1,179,276	1,183,141
Natural science 1/.....	59,550	57,759	52,642	50,403	49,301	54,241	56,757	62,837	68,880	70,844
Mathematics.....	15,267	16,388	16,626	16,122	15,439	14,674	14,784	14,931	14,853	14,631
Computer science.....	39,121	42,195	39,927	34,896	30,963	27,695	25,410	24,958	24,580	24,553
Agricultural science.....	15,879	14,740	16,082	14,331	13,559	8,411	8,432	8,432	8,432	12,947
Social science.....	125,033	127,558	131,935	136,717	146,737	159,368	170,105	182,166	186,585	187,273
Engineering.....	77,572	76,820	74,425	70,154	66,947	64,705	62,187	61,941	62,705	63,012
Other.....	658,458	664,892	668,895	683,410	707,225	733,057	770,322	794,807	813,241	809,880

1/ Natural sciences include physical, biological, earth, atmospheric, and oceanographic sciences.

2/ In Japanese data, engineering includes computer science.

SOURCES: Government of Japan, Ministry of Education, Science and Culture, Basic Education Survey, 1993; and the National Science Foundation, SRS, *Science and Engineering Degrees 1966–94*, NSF 96-321 (Arlington, VA, 1996).

**Table A-17. Number of first-university degrees by fields and as a percent of the
22-year-old population: 1994**

Field	Japan		United States	
	Number of degrees	Percent of population	Number of degrees	Percent of population
Total.....	461,898	23.3%	1,183,141	32.1%
Natural science.....	16,044	0.8	110,028	3.0
Agriculture.....	13,361	0.7	12,947	0.4
Social science.....	186,580	9.6	187,273	5.1
Engineering.....	91,184	4.8	63,012	1.7
Other.....	154,729	7.9	809,881	4.2

NOTE: Differences in taxonomies: social science degrees in Japan combine economics, business administration, and marketing within economics; law is included within political sciences; computer science is included within engineering.

SOURCES: Government of Japan, Ministry of Education, Science and Culture, Basic Education Survey, 1993; and the National Science Foundation, SRS, *Science and Engineering Degrees 1966-94*, NSF 96-321 (NSF: Arlington, VA, 1996).

Table A-18. Undergraduate and graduate enrollments in science and engineering: 1975-94

Page 1 of 2

Field	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	Japan									
	Undergraduate Enrollment									
Total.....	1,652,003	1,702,235	1,747,057	1,769,331	1,754,343	1,741,504	1,725,814	1,716,956	1,729,632	1,734,080
Total science & engineering.....	1,131,848	1,197,566	1,222,648	1,229,842	1,207,301	1,193,968	1,175,983	1,163,823	1,169,720	1,171,006
Natural sciences.....	37,495	38,455	39,704	40,781	40,484	40,381	40,701	40,702	42,047	42,560
Mathematics.....	12,731	13,088	13,301	13,743	14,094	14,198	14,332	14,486	15,550	15,886
Agricultural sciences.....	47,296	48,050	48,678	54,684	48,239	48,377	48,029	47,947	48,391	48,503
Social sciences.....	694,987	752,868	769,934	767,401	757,552	748,130	733,694	722,029	719,430	716,188
Engineering/comp. sci.....	339,339	345,105	351,031	353,233	346,932	342,882	339,227	338,659	344,302	347,869
Other.....	520,155	504,669	524,409	539,489	547,042	547,536	549,831	553,133	559,912	563,074
	Graduate Enrollment									
Total.....	48,464	51,856	53,251	53,267	53,244	53,992	55,603	58,642	62,000	65,692
Total science & engineering.....	32,198	34,907	35,791	35,084	34,061	33,853	34,084	36,117	38,294	40,452
Natural sciences.....	4,839	5,302	5,428	5,513	5,468	5,482	5,460	5,518	5,596	5,831
Mathematics.....	742	794	823	815	834	848	864	925	993	1,015
Agricultural sciences.....	3,699	4,077	4,064	3,878	3,786	3,641	3,712	4,588	5,529	5,834
Social sciences.....	6,882	6,882	6,924	6,926	7,025	6,480	6,249	6,335	6,490	6,681
Engineering/comp. sci.....	16,036	17,852	18,552	17,952	16,948	17,402	17,799	18,751	19,686	21,091
Other.....	16,266	16,949	17,460	18,183	19,183	20,139	21,519	22,525	23,706	25,240
	United States									
	Undergraduate Enrollment									
Total.....	7,449,816	7,362,827	7,488,772	7,478,376	7,599,805	7,826,514	7,915,285	7,913,659	7,989,679	7,939,920
Total science & engineering.....	NA	277,679	248,420	334,080	366,299	397,344	420,402	435,330	441,205	429,499
Natural sciences.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Math/comp. sciences.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Agricultural sciences.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Social sciences.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Engineering.....	NA	277,679	248,420	334,080	366,299	397,344	420,402	435,330	441,205	429,499
Other.....	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Graduate Enrollment									
Total.....	1,267,537	1,338,586	1,323,904	1,324,587	1,314,892	1,351,268	1,349,575	1,329,644	1,347,973	1,353,554
Total science & engineering.....	300,879	304,172	311,814	309,038	319,178	325,706	332,106	338,896	347,014	349,875
Natural sciences.....	85,176	87,597	101,224	101,051	100,878	101,040	100,612	101,755	102,968	103,547
Math/comp. sciences.....	25,333	25,719	25,160	25,936	26,736	28,912	32,339	36,990	40,713	42,985
Agricultural sciences.....	122,010	124,085	116,750	118,290	119,851	121,465	119,621	116,485	112,236	110,647
Social sciences.....	68,360	66,771	68,680	63,761	71,713	74,289	79,534	83,666	91,097	92,696
Other.....	966,658	1,034,414	1,012,090	1,015,549	995,714	1,025,562	1,017,469	990,748	1,000,959	1,003,679

See explanatory information and SOURCE at end of table.

Table A-18. Undergraduate and graduate enrollments in science and engineering: 1975-94

Page 2 of 2

Field	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Japan										
Undergraduate Enrollment										
Total.....	1,734,392	1,758,635	1,806,024	1,861,306	1,929,137	1,988,572	2,052,335	2,127,713	2,209,028	2,281,774
Total science & engineering.....	1,170,289	1,187,859	1,221,977	1,262,136	1,311,319	1,311,526	1,356,454	1,407,058	1,463,211	1,512,787
Natural sciences.....	43,700	44,088	45,314	45,828	46,856	48,581	50,075	52,587	55,312	57,578
Mathematics.....	15,978	16,218	15,762	16,104	17,141	18,197	19,298	20,513	21,424	22,441
Agricultural sciences.....	48,661	49,381	50,167	51,947	54,680	66,777	67,900	69,688	71,000	71,745
Social sciences.....	712,742	722,984	746,637	774,857	808,454	787,325	816,909	848,301	883,568	915,238
Engineering/comp. sci.....	349,208	355,188	364,097	373,400	384,188	390,646	402,272	415,969	431,907	445,785
Other.....	564,103	570,776	584,047	599,170	617,818	677,046	695,881	720,655	809,717	768,987
Graduate Enrollment										
Total.....	69,688	74,272	78,914	82,476	85,263	90,238	98,650	109,108	122,360	138,752
Total science & engineering.....	42,940	45,921	49,435	51,950	53,517	57,325	62,899	70,864	80,239	91,181
Natural sciences.....	6,042	6,446	6,935	7,462	7,915	8,299	8,945	9,679	10,972	12,159
Mathematics.....	1,028	1,060	1,131	1,182	1,232	1,252	1,377	1,553	1,858	2,374
Agricultural sciences.....	5,989	6,256	6,790	6,238	5,403	6,040	5,958	7,366	8,431	9,432
Social sciences.....	6,810	7,119	7,521	7,901	8,331	9,020	10,054	11,238	12,589	14,676
Engineering/comp. sci.....	23,071	25,040	27,058	29,167	30,636	32,714	36,565	41,028	46,389	52,540
Other.....	26,748	28,351	29,479	30,526	31,746	32,913	35,751	38,244	42,121	47,571
United States										
Undergraduate Enrollment										
Total.....	7,956,065	8,069,364	8,185,221	8,361,683	8,549,853	8,725,465	8,936,087	8,997,921	8,738,936	8,727,334
Total science & engineering.....	420,864	407,657	392,198	385,412	378,277	380,287	379,977	382,525	375,944	367,298
Natural sciences.....	NA									
Math/comp. sciences.....	NA									
Agricultural sciences.....	NA									
Social sciences.....	NA									
Engineering.....	420,864	407,657	392,198	385,412	378,277	380,287	379,977	382,525	375,944	367,298
Other.....	NA									
Graduate Enrollment										
Total.....	1,384,862	1,444,369	1,461,239	1,481,582	1,527,990	1,583,389	1,648,952	1,679,644	1,699,292	1,734,371
Total science & engineering.....	358,201	368,212	373,425	375,579	383,227	397,866	413,559	431,444	437,808	433,152
Natural sciences.....	104,070	105,541	104,974	105,580	107,348	109,472	112,643	116,879	119,769	121,087
Math/comp. sciences.....	47,341	49,316	50,575	51,323	51,766	54,165	54,668	56,700	56,511	53,609
Agricultural sciences.....	NA									
Social sciences.....	110,808	111,499	113,939	115,732	120,069	126,607	132,606	139,748	144,666	144,591
Engineering.....	95,982	101,856	103,937	102,944	104,044	107,622	113,642	118,117	116,862	113,865
Other.....	1,026,661	1,076,157	1,087,814	1,106,003	1,144,763	1,185,523	1,235,393	1,248,200	1,261,484	1,301,219

KEY: NA = not available

NOTES: Natural sciences include physical, biological, earth, atmospheric, and oceanographic sciences. In U.S. undergraduate programs, only engineering students declare their major as they enter the university. At the graduate level, agricultural sciences are included in natural sciences.

SOURCES: NSF/SRS, Selected Data on Graduate Students and Postdoctorates in Science and Engineering, Fall 1994, NSF 95-316 (Arlington, VA, 1995); Engineering Workforce Commission, American Association of Engineering Societies, Engineering and Technology Enrollments, Fall 1979-94.

Table A-19. Masters degrees in science and engineering, by field: 1975–94

Field	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	Japan									
Total.....	13,505	13,349	14,900	15,723	15,846	15,258	15,320	15,855	16,733	18,493
Natural sciences 1/.....	1,150	1,284	1,366	1,396	1,445	1,441	1,434	1,510	1,581	1,642
Mathematics.....	232	188	228	229	221	208	231	206	232	268
Agricultural sciences.....	996	992	1,138	1,217	1,136	1,119	1,064	1,020	1,162	1,925
Social sciences.....	1,778	1,727	1,663	1,740	1,713	1,689	1,660	1,510	1,519	1,599
Engineering/comp. sci.....	6,149	5,882	7,034	7,764	7,693	7,214	7,036	7,427	7,776	8,377
Other.....	3,200	3,276	3,471	3,377	3,638	3,587	3,895	4,182	4,463	4,682
United States										
Total.....	293,651	313,001	318,241	312,816	302,075	299,095	296,798	296,580	290,931	285,462
Natural sciences 1/.....	12,392	12,082	12,454	12,396	12,306	11,737	11,257	11,434	10,985	10,969
Math/comp. sci.....	6,637	6,466	6,496	6,421	6,101	6,515	6,787	7,666	8,160	8,939
Agricultural sciences.....	2,439	2,602	2,906	3,150	3,137	3,095	3,092	3,268	3,395	3,262
Social sciences.....	26,563	27,812	29,529	29,217	27,403	26,799	26,779	26,643	26,290	25,249
Engineering.....	15,167	16,045	16,012	16,080	15,279	15,943	16,451	17,557	18,886	20,145
Other.....	226,861	244,322	246,823	241,215	233,495	230,670	228,018	225,421	218,521	212,288
1985										
Japan										
Total.....	19,315	21,021	22,200	23,779	25,250	25,804	26,815	29,193	32,847	36,581
Natural sciences 1/.....	1,721	1,745	1,904	2,072	2,246	2,126	2,528	2,667	2,872	3,091
Mathematics.....	271	274	309	305	352	379	385	400	455	541
Agricultural sciences.....	2,078	2,172	2,159	2,300	2,505	1,606	1,596	1,763	2,072	2,297
Social sciences.....	1,715	1,740	1,831	1,947	2,115	2,291	2,473	2,866	3,250	3,510
Engineering/comp. sci.....	8,692	9,704	10,495	11,220	12,024	12,865	13,254	14,451	16,364	18,096
Other.....	4,838	5,386	5,502	5,935	6,008	6,537	6,579	7,046	7,834	9,046
United States										
Total.....	287,213	289,829	290,532	300,091	311,050	324,947	338,498	354,207	370,973	389,008
Natural sciences 1/.....	10,859	10,935	10,624	10,438	10,648	10,294	10,082	10,195	10,202	10,957
Math/comp. sci.....	9,989	11,241	11,808	12,600	12,829	13,327	12,956	13,320	14,100	14,350
Agricultural sciences.....	3,113	2,975	2,776	2,746	2,570	2,634	2,600	3,037	3,272	3,410
Social sciences.....	25,629	25,584	25,325	25,145	26,635	27,538	28,717	29,537	31,187	33,977
Engineering.....	20,972	21,096	22,070	22,726	23,743	23,995	24,013	25,018	27,664	28,717
Other.....	212,128	213,717	213,381	221,924	230,269	243,351	260,130	273,100	284,548	297,597

1/ Natural sciences include physical, biological, earth, atmospheric, and oceanographic sciences.

NOTE: In Japanese data, computer science degrees are included in engineering.

SOURCES: Government of Japan, Ministry of Education, Science and Culture, Basic Education Survey, 1993; and the National Science Foundation, SRS, *Science and Engineering Degrees 1966–94*, NSF 96-321 (Arlington, VA, 1996).

Table A-20. Doctoral degrees in science and engineering, by field: 1975–94

Type and field	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	Japan																			
	All earned doctoral degrees—university-based and ronbun "thesis" doctorates																			
Total.....	4,592	5,138	5,322	5,648	5,812	6,269	6,599	6,810	7,233	7,477	7,978	8,533	9,157	9,602	10,036	10,633	10,885	11,576	10,919	11,367
Natural sciences 1/.....	676	717	843	782	814	822	791	762	774	807	860	820	837	881	876	835	892	1,009	934	1,081
Mathematics.....																				
Agricultural sciences.....	381	490	518	442	430	527	529	521	515	614	697	646	715	746	734	719	870	824	816	952
Social sciences.....	84	85	88	88	76	76	76	93	97	90	127	136	149	167	177	183	200	243	249	278
Engineering/comp. sci. 2/.....	986	1,079	1,043	1,166	1,195	1,186	1,236	1,309	1,290	1,291	1,404	1,493	1,547	1,717	1,774	1,967	2,094	2,362	2,278	2,501
Other.....	2,465	2,767	2,830	3,170	3,297	3,658	3,967	4,125	4,557	4,675	4,890	5,438	5,909	6,091	6,475	6,929	6,829	7,138	6,458	6,555
University based doctoral degrees																				
Total.....	1,658	1,814	1,859	1,974	2,154	2,290	2,424	2,318	2,401	2,725	3,004	3,252	3,608	3,949	4,349	4,548	4,779	5,134	4,477	4,925
Natural sciences 1/.....	354	388	441	425	469	457	433	395	397	459	497	479	464	518	531	522	586	638	563	710
Mathematics.....																				
Agricultural sciences.....	135	160	187	181	165	193	191	191	192	193	237	198	274	322	304	337	385	376	368	504
Social sciences.....	29	24	24	25	22	20	27	34	25	27	34	37	41	42	52	73	67	90	96	125
Engineering/comp. sci. 2/.....	459	490	455	523	545	523	541	563	489	447	480	505	621	788	792	882	983	1,184	1,100	1,323
Other.....	681	752	752	820	953	1,097	1,232	1,139	1,298	1,599	1,756	2,033	2,208	2,279	2,670	2,734	2,758	2,846	2,166	2,263
Ronbun "thesis" doctoral degrees																				
∞ Total.....	2,934	3,324	3,463	3,674	3,658	3,979	4,175	4,492	4,832	4,752	4,974	5,281	5,549	5,653	5,687	6,085	6,106	6,442	6,442	6,442
Natural sciences 1/.....	322	329	402	357	345	365	358	367	377	348	363	341	373	363	345	313	306	371	371	371
Mathematics.....																				
Agricultural sciences.....	246	330	331	261	265	334	338	330	323	421	460	448	441	424	430	382	485	448	448	448
Social sciences.....	55	61	64	63	54	56	49	59	72	63	93	99	108	125	125	110	133	153	153	153
Engineering/comp. sci. 2/.....	527	589	588	643	650	663	695	746	801	844	924	988	926	929	982	1,085	1,111	1,178	1,178	1,178
Other.....	1,784	2,015	2,078	2,350	2,344	2,561	2,735	2,986	3,259	3,076	3,134	3,405	3,701	3,812	3,805	4,195	4,071	4,292	4,292	4,292
United States																				
Total.....	32,952	32,946	31,716	30,875	31,239	31,020	31,356	31,111	31,282	31,337	31,298	31,899	32,367	33,499	34,324	36,068	37,517	38,853	39,754	41,011
Natural sciences 1/.....	8,103	7,863	7,676	7,601	7,817	7,864	7,995	8,195	8,195	8,336	7,326	7,486	7,679	8,157	8,099	8,589	9,086	9,372	9,562	9,996
Math/comp. sci. 2/.....	1,147	1,003	964	959	979	962	960	940	987	993	998	1,128	1,190	1,264	1,471	1,597	1,839	1,927	2,024	2,022
Agricultural sciences.....	905	788	782	853	855	912	982	951	1,015	997	1,111	998	977	1,015	1,086	1,176	1,074	1,063	969	1,078
Social sciences.....	6,538	6,768	6,720	6,668	6,582	6,470	6,774	6,494	6,672	6,506	6,335	6,450	6,337	6,310	6,532	6,614	6,806	6,873	7,190	7,289
Engineering.....	3,011	2,838	2,648	2,425	2,494	2,479	2,528	2,646	2,781	2,913	3,166	3,376	3,712	4,187	4,543	4,894	5,215	5,439	5,696	5,822
Other.....	13,248	13,686	12,926	12,369	12,512	12,333	12,117	11,885	11,632	11,592	12,362	12,461	12,472	12,566	12,593	13,198	13,497	14,179	14,313	14,800

1/ Natural sciences include physical, biological, earth, atmospheric, and oceanographic sciences.

2/ In Japanese higher education data, computer science is included in engineering.

NOTE: Data for total and Ronbun "thesis" doctorates are estimated for 1993–94. Data for university-based doctoral degrees are taken from the Monbusho published survey of education.

SOURCES: Government of Japan, Ministry of Education, Science and Culture, unpublished tabulations, 1996; and National Science Foundation, Science Resources Studies Division, *Selected Data on Science and Engineering Doctorate Awards: 1995*, NSF 96-303 (NSF: Arlington, VA, 1996).

Table A-21. Doctoral degrees by field as a percent of the 29-year-old population: 1994

Field	Japan		United States	
	[Number]	[Percent]	[Number]	[Percent]
Total.....	11,563	0.66%	41,011	1.08%
Natural sciences & engineering total.....	4,534	0.26	18,922	0.50
Natural sciences.....	1,081	0.06	12,018	0.32
Agricultural sciences.....	952	0.05	1,078	0.03
Social sciences.....	278	0.02	7,289	0.19
Engineering.....	2,501	0.14	5,826	0.15
Other.....	6,751	0.39	14,800	0.39

SOURCES: Government of Japan, Monbusho, Annual Survey of Education; for United States, National Science Foundation, Science Resources Studies Division, *Selected Data on Science and Engineering Doctorate Awards: 1995*, NSF 96-303 (NSF: Arlington, VA, 1996).

**Table A-22. Distribution of higher education R&D expenditures,
by field: 1993**

Field	Japan	United States
[Percent]		
Total.....	100.0%	100.0%
Natural sciences.....	9.4	35.0
Math/computer sciences 1/.....	N/A	3.0
Agricultural.....	4.3	7.8
Social sciences.....	24.0	6.2
Engineering.....	22.4	15.8
Medical.....	25.0	26.5
Other.....	14.9	5.5

1/ In Japanese data, mathematics is included in natural sciences, computer science in engineering.

KEY: NA = not available

NOTES: In Japan, R&D expenditures include faculty salaries; all university and junior college teachers are regarded as researchers. The high proportion of resources in the social sciences reflects the inclusion of the salaries of large numbers of social science faculty. Natural sciences include physical, biological, earth, atmospheric, and oceanographic sciences. Social sciences include psychology.

SOURCES: Government of Japan, Management and Coordination Agency, Report on the Survey of Research and Development, 1995; and National Science Foundation, *Academic Science and Engineering R&D Expenditures, 1993*, NSF 95-332 (Arlington, VA, 1995).

Table A-23. Scientific and technical articles, by field: 1981-93

Page 1 of 2

Field	Article publication year						
	1981	1983	1985	1987	1989	1991	1993
	Japan [Number]						
All fields.....	25,086	26,368	29,617	28,894	32,832	34,375	36,674
Clinical medicine.....	5,908	6,730	7,861	8,408	9,559	10,269	11,163
Biomedical research.....	3,429	3,776	4,339	4,556	5,175	5,442	5,803
Biology.....	2,404	2,371	2,456	2,267	2,363	2,557	2,543
Chemistry.....	5,926	5,571	5,887	5,744	5,907	6,173	6,117
Physics.....	3,750	3,750	4,775	4,557	6,116	6,088	6,982
Earth and space sciences.....	394	381	592	644	736	725	797
Engineering and technology.....	2,827	3,290	3,213	2,460	2,580	2,777	2,976
Mathematics.....	449	498	495	258	395	343	293
United States [Number]							
All fields.....	132,279	132,415	137,771	134,497	140,833	142,333	140,588
Clinical medicine.....	48,072	48,055	50,595	49,904	50,510	50,142	50,258
Biomedical research.....	21,847	22,496	24,461	24,542	26,541	26,918	27,120
Biology.....	14,740	14,216	13,083	12,231	12,726	12,862	11,304
Chemistry.....	10,880	11,010	11,585	11,827	12,405	13,086	13,252
Physics.....	13,053	13,021	15,903	16,078	17,649	18,077	16,912
Earth and space sciences.....	7,257	6,862	7,663	7,797	7,770	8,138	8,522
Engineering and technology.....	12,486	13,105	10,822	9,225	9,568	9,999	10,051
Mathematics.....	3,943	3,648	3,659	2,893	3,664	3,111	3,170

See explanatory information and SOURCE at end of table.

Field	Article publication year						
	1981	1983	1985	1987	1989	1991	1993
	Japan						
[Percent]							
All fields.....	6.8%	7.1%	7.6%	7.6%	8.1%	8.5%	8.8%
Clinical medicine.....	5.1	5.6	6.3	6.7	7.3	7.9	8.5
Biomedical research.....	6.2	6.6	6.7	7.1	7.5	7.9	8.4
Biology.....	6.1	6.3	7.0	6.9	6.9	7.5	7.6
Chemistry.....	10.9	10.3	10.7	10.8	10.5	10.9	10.5
Physics.....	8.2	8.0	8.8	8.5	10.0	10.0	10.9
Earth and space sciences.....	2.3	2.3	3.3	3.5	3.9	3.7	3.8
Engineering and technology.....	9.2	10.3	11.5	10.1	10.1	10.1	10.3
Mathematics.....	4.3	5.3	5.2	3.6	4.3	4.6	3.6
United States							
[Percent]							
All fields.....	35.9	35.4	35.3	35.6	34.9	35.1	33.6
Clinical medicine.....	41.3	40.3	40.3	39.9	38.8	38.5	38.4
Biomedical research.....	39.5	39.3	37.8	38.2	38.7	38.9	39.4
Biology.....	37.6	37.6	37.5	37.3	37.2	37.6	33.7
Chemistry.....	20.0	20.3	21.0	22.2	22.1	23.1	22.8
Physics.....	28.6	27.8	29.4	30.1	28.7	29.8	26.5
Earth and space sciences.....	42.7	41.6	43.0	42.6	41.5	41.7	40.6
Engineering and technology.....	40.7	40.9	38.6	37.9	37.6	36.2	34.6
Mathematics.....	38.2	38.5	38.3	40.7	39.9	42.1	38.9

SOURCES:

special tabulation, 1995.

**Table A-24. U.S. patents granted to Japanese
and U.S. inventors: 1980–93**

Year	Japan	United States
	[Number]	
1980.....	7,124	37,356
1981.....	8,388	39,223
1982.....	8,149	33,896
1983.....	8,793	32,871
1984.....	11,110	38,367
1985.....	12,746	39,555
1986.....	13,209	38,126
1987.....	16,557	43,518
1988.....	16,158	40,496
1989.....	20,168	50,185
1990.....	19,524	47,393
1991.....	21,027	51,183
1992.....	21,925	52,253
1993.....	22,292	53,236

SOURCE: National Science Board, *Science and Engineering Indicators, 1996*, NSB 96-21, (Washington, D.C.: Government Printing Office, 1996).

**Table A-25. Output per worker-hour
in manufacturing: 1977–94**

Year	Japan	United States
	[Index 1982 = 100]	
1977.....	77.1	96.2
1978.....	81.3	96.3
1979.....	87.7	94.9
1980.....	91.1	92.9
1981.....	95.0	96.2
1982.....	100.0	100.0
1983.....	102.5	102.2
1984.....	107.9	103.5
1985.....	114.9	106.7
1986.....	113.0	109.5
1987.....	122.4	116.6
1988.....	129.6	119.2
1989.....	138.7	119.9
1990.....	149.1	122.1
1991.....	156.9	124.9
1992.....	156.6	127.5
1993.....	159.5	132.0
1994.....	164.2	137.4

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, September 1995.

Table A-26. Value of internationally traded technological know-how receipts and payments: 1990–93 1/

Receipts and payments	Japan			
	1990	1993	1990	1993
	[Billions of current yen]		[Millions of current dollars 2/]	
Receipts.....	¥373.90	¥450.20	\$3,362.00	\$4,049.00
Payments.....	869.40	814.70	7,818.00	7,326.00
Balance.....	(495.50)	(364.50)	(4,456.00)	(3,277.00)
Ratio of receipts to payments.....	0.43	0.55	0.43	0.55
United States				
Receipts.....			2,333.00	2,755.00
Payments.....			665.00	1,036.00
Balance.....			(1,668.00)	(1,719.00)
Ratio of receipts to payments.....			3.51	2.66

1/ Technological know-how includes industrial processes, patents, and other proprietary inventions and technologies.

2/ IMF rate yen to a dollar, 1990: ¥144.8; 1993: ¥111.20.

SOURCES: Government of Japan, *Indicators of Science and Technology* (1996); National Science Foundation, Science Resources Studies Division, *Science and Engineering Indicators, 1996*, NSB 96-21, Arlington, VA.

Table A-27. Japanese manufacturing trade in technical know-how by selected industries: 1990 and 1993

Industry	1990			1993		
	Payments	Receipts	Receipts/payments	Payments	Receipts	Receipts/payments
[Millions of current yen]						
All manufacturing, total.....	¥32,6901	¥3,16241	0.97	¥35,9601	¥39,4144	1.10
Food.....	8,471	8,337	0.98	8,430	5,432	0.64
Textiles.....	4,847	4,648	0.96	6,188	4,854	0.78
Chemicals and allied products.....	56,866	53,616	0.94	61,368	59,348	0.97
Industrial chemicals.....	23,242	29,451	1.27	18,658	22,201	1.19
Drugs and medicines.....	21,483	813	0.04	34,591	31,020	0.90
Petroleum and coal.....	3,752	487	0.13	3,077	237	0.08
Rubber.....	3,787	4,804	1.27	4,114	5,285	1.28
Ceramics.....	4,092	9,025	2.21	3,828	9,808	2.56
Iron and steel.....	4,776	21,572	4.52	3,403	13,294	3.91
Non-ferrous metals.....	10,702	7,054	0.66	3,620	3,640	1.01
Fabricated metals.....	2,279	2,004	0.88	1,505	4,698	3.12
General machinery.....	32,986	13,210	0.40	25,554	18,425	0.72
Electrical machinery.....	120,553	86,708	0.72	159,159	127,377	0.80
Electrical equipment.....	28,517	28,164	0.99	24,431	8,288	0.34
Communications and electronic equipment....	92,036	58,544	0.64	134,729	10,975	0.08
Motor vehicles.....	7,248	83,042	11.46	8,748	124,249	14.20
Professional and scientific instruments.....	8,302	12,556	1.51	22,747	640	0.03

SOURCE: Government of Japan, Management and Coordination Agency, *Report on the Survey of R&D*, Tokyo, 1995.

Table A-28. Japanese trade balance with the United States in advanced technology products: 1990-94 1/

Year	Balance	Exports to U.S.	Imports from U.S.	Balance	Exports to U.S.	Imports from U.S.
	[Millions of current dollars]			[Millions of current dollars]		
	All technologies			Computer Integrated Manufacturing		
1990.....	\$7,233.1	\$19,450.2	\$12,217.1	\$510.4	\$1,103.5	\$593.1
1991.....	7,434.2	19,799.5	12,365.3	585.7	1,247.1	661.4
1992.....	8,854.7	21,458.4	12,603.7	628.3	1,106.5	478.2
1993.....	12,789.4	24,936.1	12,146.7	959.3	1,504.2	544.9
1994.....	14,317.5	28,732.2	14,414.7	1,144.1	1,963.1	819.0
	Biotechnologies			Material Design		
1990.....	(177.1)	1.4	178.5	44.9	482.0	437.1
1991.....	(174.7)	1.9	176.6	(36.5)	461.8	498.3
1992.....	(152.2)	1.6	153.8	65.3	195.3	130.0
1993.....	(138.1)	1.3	139.4	51.2	240.7	189.5
1994.....	(187.9)	1.0	188.9	128.4	337.5	209.1
	Life Sciences			Aerospace		
1990.....	56.5	746.6	690.1	(3,593.0)	487.3	4080.3
1991.....	162.4	889.6	727.2	(3,135.9)	614.5	3750.4
1992.....	185.4	910.4	725.0	(3,791.6)	575.3	4366.9
1993.....	50.4	891.5	841.1	(2,980.9)	501.9	3482.9
1994.....	(111.0)	895.9	1,006.9	(3,329.1)	555.8	3884.9
	Opto-electronics			Weapons		
1990.....	688.2	798.3	110.1	(89.3)	2.2	91.5
1991.....	1,461.8	1,603.1	141.3	(98.0)	2.6	100.6
1992.....	1,882.5	1,939.5	57.0	(84.5)	2.6	87.1
1993.....	1,746.4	1,823.7	77.3	(106.4)	3.4	109.8
1994.....	1,291.1	1,454.0	162.9	(96.6)	4.9	101.5
	Computers and Telecommunications			Nuclear Technology		
1990.....	8,703.6	13,078.2	4,374.6	(726.4)	1.8	728.2
1991.....	7,239.2	11,611.7	4,372.5	(812.6)	1.4	814
1992.....	8,168.7	12,444.4	4,275.7	(811.4)	2.2	813.6
1993.....	10,197.6	14,319.4	4,121.8	(823.5)	4.4	827.9
1994.....	11,343.0	16,146.9	4,803.9	(851.8)	2.4	854.2
	Electronics			Software		
1990.....	1,815.5	2,749.0	933.5	(119.9)	22.2	142.1
1991.....	2,242.8	3,365.7	1,122.9	(139.1)	31.3	170.4
1992.....	2,764.3	4,280.7	1,516.4	(149.4)	28.7	178.1
1993.....	3,833.6	5,645.5	1,811.9	(179.3)	25.6	204.9
1994.....	4,987.3	7,370.7	2,383.4	(235.0)	26.0	261

1/ The list of advanced technology products is compiled by the U.S. Bureau of the Census. To be included in one of the categories, a product must contain a significant amount of one of the leading-edge technologies, and the technology must account for a significant portion of the product's value.

NOTE: Data reported on Japanese exports to the United States are actually U.S. imports from Japan as reported by the Bureau of the Census. Likewise, Japanese imports are U.S. exports to Japan as reported in the Census data.

SOURCE: U.S. Department of Commerce, Bureau of the Census, Foreign Trade Division.